Report of the Auditor General of Canada to the Legislative Assembly of Nunavut—2018

Independent Auditor's Report

Climate Change in Nunavut

Office of the Auditor General of Canada

Bureau du vérificateur général du Canada

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Office of the
Auditor General
of Canada

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du Canada

To the Honourable Speaker of the Legislative Assembly of Nunavut:

I have the honour to submit herewith my report on Climate Change in Nunavut to the Legislative Assembly of Nunavut in accordance with the provisions of section 48 of the *Nunavut Act*.

Yours sincerely,

Michael Ferguson, CPA, CA
FCPA, FCA (New Brunswick)

OTTAWA, 13 March 2018

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Introduction

Background

Climate change in Nunavut

1. Environment and Climate Change Canada's climate data indicates that between 1948 and 2016, average temperatures increased by up to 2.7 degrees Celsius in Nunavut and by 1.7 degrees Celsius in Canada as a whole. In Nunavut, these rises in temperature have caused changes to ice conditions, permafrost, and precipitation. The Government of Nunavut's Department of Environment has reported that this warming trend will likely continue.

2. Climate change research and local and traditional Inuit knowledge also indicate that Nunavut's climate is changing. Exhibit 1 lists some of the impacts of climate change on Nunavut and the Arctic. While not all impacts can be attributed to climate change, it is a major factor.

3. According to the Intergovernmental Panel on Climate Change, a leading cause of climate change is the emission into the atmosphere of greenhouse gases, such as carbon dioxide, from fossil fuel combustion and industrial processes. Although Nunavut is a small emitter of greenhouse gases, it is particularly vulnerable to the impacts of climate change.

Exhibit 1 Examples of impacts of climate change on Nunavut and the Arctic

Type of change	Impacts	Examples
Warming	Arctic sea ice has reduced.	The shortened and less reliable ice season has affected those who travel on sea ice. It affects cultural connections with the local environment as well as hunting and fishing, which can affect income and food security. Researchers have found that reduced sea ice has led to increased shipping activity in some areas surrounding Nunavut. This presents Nunavut with economic opportunities but also increases the risk of incidents that require emergency response, such as fuel spills. Less ice means less protection from waves and storm surges. Researchers have identified the communities of Clyde River, Hall Beach, and Kugluktuk as being vulnerable to coastal erosion and flooding.
	Permafrost is warming.	Nunavut's communities are built on permafrost, which is ground that has been frozen for two or more years. Warming air and ground temperatures have caused permafrost to warm. In some areas of Nunavut, warming permafrost has created hazards for residents, affected some land-based travel routes, and presented risks to archaeological sites. Thawing permafrost also poses risks to infrastructure, such as shifting, foundation distress, and other structural problems in buildings.

Exhibit 1 Examples of impacts of climate change on Nunavut and the Arctic (continued)

Type of change	Impacts	Examples
Changing precipitation levels	The annual average amount of regional snowfall has increased. Snow is melting earlier in the year.	In some instances, severe rain events have led to local flooding and washouts. For example, in Pangnirtung in 2008, significant damage to two bridges from a rainstorm and rapid snowmelt prevented access to the community's water reservoir, sewage treatment plant, and landfill site. In Coral Harbour in 2012, significant damage to a road and bridge from rain and rapid snowmelt caused the community to be without access to its airport for about one week. The flooding also damaged the resupply pipeline for the community's fuel tank farm.

Sources: Observed Trends in Canada's Climate and Influence of Low-Frequency Variability Modes, Environment and Climate Change Canada, 2015; Canada's Marine Coasts in a Changing Climate, Government of Canada, 2016; Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, Government of Canada, 2014; Snow, Water, Ice and Permafrost in the Arctic: Summary for Policy Makers, Arctic Monitoring and Assessment Programme, 2017; The Influence of Declining Sea Ice on Shipping Activity in the Canadian Arctic, Pizzolato, L., et al., 2016; Climate Change Geoscience Program: 2006–2011 Program Final Report, Geological Survey of Canada, 2012; Coral Harbour Airport Community Road Washout Rehabilitation Project, Department of Community and Government Services, Government of Nunavut, 2015; Upagiaqtavut: Climate Change Impacts and Adaptation in Nunavut, Government of Nunavut, 2011.

4. Virtually all of Nunavut's greenhouse gas emissions come from using fossil fuels, such as diesel, gasoline, and jet fuel. These fuels are used for a variety of purposes, such as for generating electricity, for heating homes, and for various modes of transportation, and play a key role in the daily lives of Nunavummiut (the people of Nunavut). Providing reliable energy to Nunavut's communities is particularly critical given the territory's cold Arctic winters, during which average monthly temperatures in some communities are minus 25 degrees Celsius and below.

5. Nunavut relies entirely on imported fuels, which are supplied by ship to communities during the summer season. This makes the territory vulnerable to price increases, unforeseen supply disruptions, and fuel spills.

6. In its efforts to help Nunavut adapt to climate change and reduce greenhouse gas emissions, the Government of Nunavut faces a number of challenges, such as

- delivering programs to and managing infrastructure in 25 communities, which are spread across almost 2 million square kilometres and are difficult to access (by air year-round and by sealift);
- addressing immediate priorities in areas such as health, housing, and education; and
- dealing with constraints on human resources, including high vacancies and staff turnover within the government.

7. Responding to the impacts of climate change is a shared responsibility. It requires collaboration within and across governments, and with municipalities, Inuit and non-governmental organizations, industry, and the public.

Roles and responsibilities

8. The Department of Environment's Climate Change Secretariat is the lead for climate change in the territory. The result of a merger at the end of 2016 between the Department of Environment's Climate Change Section and the Department of Economic Development and Transportation's Energy Secretariat, the Climate Change Secretariat is responsible for managing the Government of Nunavut's climate change policies and programs. This includes

- developing **adaptation** programs, policies, and partnerships, which assist Nunavut in adapting to and minimizing the projected impacts of climate change;
- leading the inter-agency development of strategies to reduce greenhouse gas emissions to lessen the territory's reliance on imported diesel;
- encouraging the exchange of knowledge and information about climate change based on science and Inuit Qaujimajatuqangit (that is, traditional Inuit knowledge and values); and
- coordinating climate change actions for government departments, agencies, and communities.

9. A number of other government departments also have roles in preparing Nunavut to adapt to climate change and reducing its greenhouse gas emissions, such as

- the Department of Community and Government Services, which manages government-owned property;
- the Nunavut Housing Corporation, which manages almost 7,000 public and staff housing units; and
- the Qulliq Energy Corporation, Nunavut's public utility.

Focus of the audit

10. This audit focused on whether selected Government of Nunavut organizations took measures to prepare for and adapt to the impacts of climate change on Nunavut and took measures to reduce greenhouse gas emissions in Nunavut.

11. This audit is important because climate change is affecting the daily life, traditional activities, and infrastructure in Nunavut. The government needs to know what it has to do to help the people of Nunavut adapt and make the territory resilient to the impacts of climate change. Increasing energy efficiency and using more renewable energy help reduce greenhouse gas emissions and the territory's dependence on fossil fuels.

Adaptation—Actions taken to prevent or reduce the negative impacts of climate change and/or build on positive impacts.

12. We examined whether the Government of Nunavut had

- developed a strategy for adapting to climate change and reducing greenhouse gas emissions,
- developed an implementation plan for the strategy,
- monitored and reported on the implementation of its strategy, and
- assessed climate change risks to Nunavut and Nunavummiut.

13. We also examined specific measures that selected government organizations had taken to adapt to climate change and reduce greenhouse gas emissions:

- the efforts of the Department of Community and Government Services and the Nunavut Housing Corporation to adapt to climate change; and
- the efforts of the Department of Community and Government Services, the Nunavut Housing Corporation, and the Qulliq Energy Corporation to reduce greenhouse gas emissions.

14. We did not examine the role of other Government of Nunavut departments or municipal governments in adapting to the impacts of climate change or in reducing greenhouse gas emissions.

15. In 2016, many legislative audit offices across Canada decided to look at the issue of climate change and developed similar audit approaches and questions to examine climate change action within their governments. As part of this initiative, the Office of the Auditor General of Canada decided to do federal and territorial climate change audits.

16. More details about the audit objective, scope, approach, and criteria are in **About the Audit** at the end of this report (see pages 25–28).

Findings, Recommendations, and Responses

Planning and preparing

Overall message

17. Overall, we found that the Government of Nunavut was not adequately prepared to respond to climate change. Although it had strategies for adapting to climate change and managing the territory's energy use and greenhouse gas emissions, it did not have implementation plans that outlined how and when the objectives of the strategies would be met and who would be responsible for what. It also did not publicly report on its implementation of either strategy. We also found that the Government of Nunavut did not fully assess the risks of climate change to Nunavut.

18. These findings matter because implementation plans provide direction to departments so that they can respond in a coordinated manner to the risks and impacts of climate change. Public reporting informs Nunavummiut about the Government of Nunavut's progress in addressing climate change and keeps it accountable. Assessing the risks of climate change ensures that the government has the information it needs to direct its actions and resources to the most important areas.

The Government of Nunavut had strategies for adapting to climate change and managing its energy use but lacked plans to implement them

What we found

19. We found that the Government of Nunavut had a strategy for responding to the impacts of climate change and a strategy for managing its energy use and reducing its reliance on fossil fuels and greenhouse gases. However, both strategies lacked clear and measurable commitments, and timelines. The government prepared draft implementation plans, which outlined the actions needed to achieve the objectives, along with timelines, deliverables, and responsibilities. However, these plans were never finalized.

20. We also found that the government did not set a target for reducing greenhouse gas emissions or publicly report on the implementation of both of its adaptation and energy strategies.

21. Our analysis supporting this finding presents what we examined and discusses the following topics:

- Adaptation strategy
- Energy strategy
- Monitoring and public reporting
- Reduction targets

Why this finding matters

22. This finding matters because strategies and implementation plans give departments direction on the priorities and actions they need to take to adapt to climate change and reduce greenhouse gas emissions. Identifying who is responsible for taking action, the expected deliverables, and the related timelines are important for tracking progress and holding the Government of Nunavut accountable for results.

23. Reporting publicly on progress is important because it tells Nunavummiut what the government has done to address the impacts of climate change and to reduce the territory's greenhouse gas emissions and its reliance on fossil fuels.

Recommendation

24. Our recommendation in this area of examination appears at paragraph 36.

Analysis to support this finding

25. **What we examined.** We examined whether the Government of Nunavut had a strategy and implementation plan for adapting to the impacts of climate change and reducing greenhouse gas emissions, and whether the government publicly reported on progress.

26. **Adaptation strategy.** In 2011, the Department of Environment released Upagiaqtavut: Climate Change Impacts and Adaptation in Nunavut, a framework for climate change adaptation initiatives in Nunavut. Its purpose is to provide strategic direction and enable Nunavummiut to better adapt to current and future changes brought on by climate change.

27. The strategy contained 11 objectives under 4 themes: partnership building, research and monitoring, education and outreach, and government policy and planning. We found that its objectives focused on actions to be taken, not on outcomes. The strategy did not explain who would be responsible for achieving the objectives and lacked timelines for completing actions.

28. The Government of Nunavut's Cabinet directed the Department of Environment to work with all departments to develop a plan to implement the strategy. In 2014, the Department of Environment, with input from other departments, produced a five-year draft action plan, which outlined the actions to be taken to achieve the objectives, the timelines for completing these actions, the deliverables, and the responsibilities for completing the actions. We found that the draft action plan was never finalized.

29. **Energy strategy.** In 2007, the Government of Nunavut released Ikummatiit: The Government of Nunavut Energy Strategy. Covering the period from 2007 to 2020, the strategy aims to reduce Nunavut's dependence on fossil fuels, improve energy security, and reduce air pollution and greenhouse gases. These objectives are to be achieved by, among other things, increasing energy efficiency and using alternatives to fossil fuels.

30. The strategy contains 42 policy actions designed to fulfill its objectives. We found that it did not state who was responsible for implementing about two thirds of the actions and did not set any timelines for completing actions.

31. After the release of the strategy, Cabinet directed the Energy Secretariat (at the time, located in the Department of Executive and Intergovernmental Affairs) to work with relevant departments to develop an implementation plan for the strategy. We found that, in 2010,

the Secretariat produced a detailed draft plan, which included descriptions of how policy actions would be implemented, timelines, deliverables, and responsibilities; however, the plan was never finalized.

32. **Monitoring and public reporting.** We found that the monitoring of the adaptation and energy strategies was limited. Although both contained commitments to produce annual public reports, these were never produced. An interdepartmental climate change working group was established to coordinate implementation and public reporting for both strategies, but the group was inactive and had not met in many years.

33. **Reduction targets.** We examined whether the Government of Nunavut had set **reduction targets for greenhouse gas emissions** and whether it was monitoring the territory's emissions. Targets are important because they communicate what the government wants to achieve and act as a benchmark for measuring progress. Monitoring emissions helps determine whether progress is being made to reduce them.

34. We found that the government did not set targets for reducing greenhouse gas emissions or other energy-related targets, such as how much power it wanted to produce using renewable energy. However, we did find that the Climate Change Secretariat was monitoring the territory's greenhouse gas emissions. A report on energy use and greenhouse gas emission trends in the territory was produced for the Secretariat in early 2017. Department officials told us that they were reviewing the report and expected to use it to establish a comprehensive greenhouse gas inventory.

35. We noted differences between Nunavut's estimated greenhouse gas emissions and those in Environment and Climate Change Canada's 2017 national greenhouse gas emission inventory. Although both sources of information indicated that Nunavut's emissions were increasing, they differed in terms of Nunavut's total emissions and the share of emissions by sector (for example, transportation, heating, and electricity). Secretariat officials told us that they were investigating these differences and were participating in a federal/territorial working group to improve emission estimates for the territories.

36. **Recommendation.** The Department of Environment, in collaboration with other key departments, should develop an implementation plan for the Government of Nunavut's climate change strategies that

- identifies priorities along with concrete actions, timelines, and costs;
- includes reduction targets for greenhouse gas emissions;

Reduction targets for greenhouse gas emissions—Targets that can be absolute or intensity targets. Absolute targets refer to reducing greenhouse gas emissions over time. Intensity targets refer to reducing the ratio of greenhouse gas emissions over time relative to a particular measurement, such as per capita or gross domestic product (GDP). Both types of targets often have a base year and target year.

- clearly identifies roles and responsibilities, including who is responsible for overseeing the implementation of the plan and accountabilities for implementing actions; and
- requires monitoring and reporting on the plan's progress.

The plan should consider actions taken to date and be informed by an assessment of climate change risks.

The Department of Environment's response. *Agreed. The Department of Environment, through the Climate Change Secretariat, will collaborate with other key departments to identify priorities, concrete actions, timelines, costs, and implementation plans for climate change strategies. These strategies aim to take action on Nunavut's greenhouse gas emissions, reliance on diesel fuel, and role in adapting and combatting climate change.*

The Climate Change Secretariat was formed in November 2016 and has since begun work on a variety of foundational projects that will well position the Department of Environment to facilitate responding to such a recommendation. Preliminary work on community energy planning, greenhouse gas emissions, and alternative energy inventories will support the Government of Nunavut's ability to identify realistic and reasonable greenhouse gas emission targets.

The Government of Nunavut did not fully assess the risks of climate change

What we found

37. We found that the Government of Nunavut did not fully assess the risks of climate change to Nunavut and Nunavummiut. For example, it did not assess which communities might be at greatest risk, how climate change could affect the delivery of government programs and services, and the impacts of climate change on biodiversity. We found that the government did assess risks for selected topics, such as the risks of climate change to sources of drinking water in communities. For seven communities, it also produced maps that identified areas unsuitable for development due to risks from the thawing of permafrost.

38. Our analysis supporting this finding presents what we examined and discusses the following topic:

- Assessing climate change risks

Why this finding matters

39. This finding matters because understanding the risks of climate change enables the Government of Nunavut to prioritize the steps it needs to take to ensure that Nunavut is resilient to the impacts of climate change. It also helps identify what steps need to be taken to ensure government services (such as the annual resupply of fuel to communities) and

infrastructure (such as airports, health centres, and schools) are resilient to climate change. Identifying areas in communities at risk due to changes in permafrost helps local governments avoid developing in these areas.

Recommendation

40. Our recommendation in this area of examination appears at paragraph 49.

Analysis to support this finding

41. **What we examined.** We examined whether the Government of Nunavut had assessed the risks of climate change, including their impact and how likely they were to occur.

42. **Assessing climate change risks.** We found that the Government of Nunavut's adaptation strategy identified the potential risks that climate change poses to Nunavut, including the potential impacts on current and future generations. However, it had not analyzed or ranked these risks in terms of their impacts and the likelihood that they would occur, nor had it assessed which communities and regions could be most affected by climate change.

43. The five-year draft action plan that was prepared for Nunavut's adaptation strategy contained several proposed actions designed to better understand the risks of climate change, including the following to be led by the Department of Environment:

- assessing the risks of climate change to the government;
- developing tools to assess the costs and benefits of taking actions to adapt to climate change and the costs—environmental, economic, and social—of not acting; and
- identifying the impacts of climate change to biodiversity, including on hunting and traditional ways of life.

44. These are important steps to take to better understand the risks of climate change; however, we found that the Department of Environment did not follow through on these actions. Department officials noted difficulties in weighing and ranking one impact against another as a challenge to assessing risks.

45. We found that risks for selected topics were assessed. An assessment of climate change risks to Nunavut's mining sector, including to infrastructure such as access roads, airstrips, and tailings (mining waste) facilities, was produced for the Department of Environment and other organizations. The Department also began to develop guidance for its staff on how to consider climate change during their reviews of environmental impact assessments of proposed projects. Climate change considerations could include the project's greenhouse gas emissions and the potential impact of climate change on the proposed project.

46. We found that the Department of Community and Government Services, with support from the Department of Environment and other organizations, conducted a terrain mapping project to inform community planning and help identify areas unsuitable for development. The project produced maps for seven communities (Arviat, Baker Lake, Cape Dorset, Gjoa Haven, Kimmirut, Kugluktuk, and Pangnirtung). These maps identified areas at risk of instability due to changes in permafrost and other hazards, such as proximity to a body of water.

47. We also found that an assessment of the risks to primary sources of drinking water was prepared in 2017 for the Department of Community and Government Services and the Department of Health (Exhibit 2).

Exhibit 2 Primary sources of drinking water in some of Nunavut's communities were identified as high risk

In 2017, a desktop risk assessment of primary sources of drinking water in Nunavut's communities (outside of Iqaluit) was completed for the Department of Community and Government Services and the Department of Health. The assessment considered a number of factors, including the size of the community's watershed, population growth, and future climate scenarios. The assessment identified six communities at high risk of water scarcity between 2016 and 2040, as a result of their watershed sizes, of growing water demands, and of climate change: Cambridge Bay, Cape Dorset, Clyde River, Igloolik, Rankin Inlet, and Taloyoak. According to Department of Community and Government Services officials, the results of the assessment were being used to determine next steps, including onsite research.

48. Finally, we found that the Department of Environment acted to increase awareness of the risks of climate change. It created the Nunavut Climate Change Centre, a web-based climate change resource to provide climate change information to Nunavummiut. The website includes an online database of information about permafrost. The Department also provided training to government officials on climate change.

49. **Recommendation.** The Department of Environment's Climate Change Secretariat, in collaboration with other Government of Nunavut organizations, should analyze and rank the risks of climate change to Nunavut on the basis of their potential impacts and how likely they are to occur. Results of this analysis should be used to inform future climate change priorities and actions.

The Department of Environment's response. *Agreed. The Department of Environment intends to work with other Government of Nunavut organizations and external bodies to identify and rank climate change risks and hazards to Nunavut.*

The Department of Environment will host a pan-northern meeting in March 2018 on permafrost hazard mapping. This will bring northern communities and government decision makers together to determine risks, opportunities, and recommendations to better manage and respond to permafrost thaw and other climate change risks. Best practices and lessons learned from this session will help inform future work conducted to address other identified risks. Additional work is scheduled to begin the development of climate change risk mitigation criteria for decision makers.

Taking action

Overall message ➔

50. Overall, we found that the Department of Community and Government Services and the Nunavut Housing Corporation had measures to help protect buildings from the impacts of climate change on permafrost, but these measures were not fully implemented. These organizations and the Qulliq Energy Corporation did take steps to improve the energy efficiency of government assets, including government buildings in Iqaluit, public housing units, and power plants. However, the use of renewable energy, such as solar and wind, was limited due in part to high capital costs.

51. These findings matter because infrastructure can be protected from the impacts of climate change. Designing buildings with the potential impacts of climate change on permafrost in mind and assessing existing buildings and other infrastructure for potential problems from changing permafrost can reduce the risk of damage and the need for costly repairs. A government that owns energy-efficient assets and uses renewable energy sources can help reduce the demand for and dependence on fossil fuels, and the emissions of greenhouse gases. This can also support the government's vision of self-reliant Nunavummiut and of Qanuqtuurniq—the Inuit societal value of being innovative and resourceful.

Context

52. Climate change has caused air and ground temperatures in Canada's north to increase, causing permafrost to warm. As permafrost warms, the ground can thaw, causing it to settle. Increased ground temperatures can also cause the active layer—the top layer of ground that freezes and thaws in permafrost zones—to deepen, increasing upward ground movement due to frost heave.

53. When ground settles and frost heave occurs, buildings on permafrost, such as schools, health centres, and public housing units, can shift and suffer distress or damage. This can include cracks in foundations and walls, uneven floors, doors and windows that do not close or seal properly, and leaks from supply or sewage lines, all of which can require repairs.

54. According to data collected by Natural Resources Canada at selected sites across Nunavut, permafrost temperatures increased between 2008 and 2014. With increased temperatures projected to occur because of climate change, warming of permafrost is expected to continue.

55. Putting skirting or piling snow around foundations can also degrade and thaw permafrost, because it insulates permafrost from cold air and allows the heat from the building to warm the permafrost below. Water that pools around buildings due to poor drainage or melting snow can also cause permafrost to degrade.

56. Canadian standards and technical guidance outline measures that can be taken to protect infrastructure from the impacts of degrading and thawing permafrost. These include the National Standard of Canada for Geotechnical Site Investigations for Building Foundations in Permafrost Zones (2017); the National Standard of Canada for Moderating the Effects of Permafrost Degradation on Existing Building Foundations (2014); and the Technical Guide—Infrastructure in Permafrost: A Guideline for Climate Change Adaptation (2010). These measures involve

- conducting geotechnical site investigations of planned building sites, which consider permafrost conditions and projected changes due to climate change (done before construction, these investigations are used to inform the design of foundations that are appropriate for the building site and are resilient to the impacts of climate change on permafrost over the life of the structure); and
- periodically inspecting and assessing buildings for signs of distress or damage due to ground settlement, frost heave, and permafrost degradation, and taking appropriate measures to avoid future damage, such as adjusting or levelling foundations.

57. Once the thawing of permafrost begins, stopping it is usually difficult and expensive. Therefore, it is essential to help preserve permafrost both beneath and beside a building. This can be achieved by implementing measures such as

- properly managing snow and drainage around buildings to avoid water from pooling (Exhibit 3), and
- ensuring spaces underneath buildings are properly ventilated to prevent permafrost from warming.

Exhibit 3 Ensuring proper drainage around facilities, such as the Leo Ussak School in Rankin Inlet, can help avoid water from pooling and reduce the risk of permafrost degradation

Photo: © Department of Community and Government Services

The Department of Community and Government Services and the Nunavut Housing Corporation had measures to safeguard government buildings from the impacts of climate change on permafrost, but these measures were not fully implemented

What we found

58. We found that the Department of Community and Government Services and the Nunavut Housing Corporation collected information on permafrost conditions through geotechnical site investigations to inform the design of their buildings and other infrastructure. Climate projections were considered in most of the cases we examined. We also found that both organizations did not always carry out building assessments as scheduled, which can help identify potential problems caused by changes in permafrost. Finally, we found that both organizations did not consistently incorporate measures into their operations and maintenance procedures for managing snow and water around buildings that could help prevent permafrost degradation.

59. Our analysis supporting this finding presents what we examined and discusses the following topics:

- Geotechnical site investigations
- Building assessments
- Snow and water management

Why this finding matters

60. This finding matters because having measures in place to safeguard Nunavut's buildings from changing permafrost conditions can prevent damage from occurring. Considering climate projections when conducting geotechnical site investigations helps ensure that building foundations are resilient to the potential impacts of climate change on permafrost. Periodically assessing existing buildings and proactively managing water and snow can help minimize and avoid damage and related repairs that can occur due to permafrost degradation and thaw.

Recommendations

61. Our recommendations in this area of examination appear at paragraphs 64, 71, 72, and 74.

Analysis to support this finding

62. **What we examined.** We examined whether the Department of Community and Government Services and the Nunavut Housing Corporation had

- conducted geotechnical site investigations for selected projects (seven infrastructure projects built by the Department of Community and Government Services and nine public housing units built by the Nunavut Housing Corporation) and considered climate projections in these investigations;
- assessed buildings (such as schools, health centres, and housing units) for signs of damage from thawing permafrost; and
- developed procedures to manage water and snow around their facilities to avoid permafrost degradation.

63. **Geotechnical site investigations.** We found that both the Department of Community and Government Services and the Nunavut Housing Corporation conducted geotechnical site investigations or used geotechnical information to inform the design and construction of infrastructure on permafrost. Climate projections were considered in six of the seven investigations conducted by the Department and five of the nine investigations conducted by the Corporation. Incorporating this type of information is important for ensuring that building foundations and other infrastructure are resilient to climate change.

64. **Recommendation.** The Department of Community and Government Services and the Nunavut Housing Corporation should ensure that climate change projections are incorporated into geotechnical site investigations where required.

The Department of Community and Government Services' response. *Agreed. The Department of Community and Government Services will initiate measures to ensure that climate change projections are incorporated into the geotechnical site investigations where required going forward.*

The Nunavut Housing Corporation's response. *Agreed. The Nunavut Housing Corporation will incorporate climate change predictions into future geotechnical studies, where necessary.*

65. **Building assessments.** We found that both the Department of Community and Government Services and the Nunavut Housing Corporation had procedures for assessing those parts of buildings, such as foundations, that could be affected by permafrost settlement and degradation. However, these assessments were not always carried out as scheduled. As a result, the Department and the Corporation may have missed signs of distress being caused by changing permafrost conditions and may have delayed steps that could have been taken to avoid or reduce damage.

66. The Department of Community and Government Services officials indicated that the Department conducts semi-annual and five-year building condition assessments as part of the management of its buildings. These assessments cover a range of building components, such as windows, ceilings, foundations, and pads that could be affected by changing permafrost conditions. The Regional Director, Infrastructure, is responsible for the semi-annual assessments, while the Department's Technical Services is responsible for the more detailed five-year assessments.

67. Department officials indicated that semi-annual assessments were often done annually due to a lack of resources and to weather-related problems. According to documentation provided by the Department, semi-annual or annual assessments were done from October 2015 to October 2017 for buildings in the Kivalliq and Qikiqtaaluk regions except in Iqaluit and Rankin Inlet, where the buildings were not assessed. Government buildings under the Department's responsibility were assessed in the Kitikmeot Region only in 2017. Buildings in Cambridge Bay were not assessed from October 2015 to October 2017. We found that the level of detail in the assessment reports that were completed varied; the assessments also did not always follow a standardized template, which could have helped ensure that all relevant aspects of a building, including structural aspects, were considered.

68. For detailed assessments, we found that a third party did five-year building condition assessments of government buildings in 2012. Since then, the Department put a new process in place requiring that a minimum number of buildings undergo a detailed assessment every year and that all assets be covered within a five-year period. We found, on the basis of data it provided, that the Department had completed detailed assessments for the buildings under its responsibility in 12 of Nunavut's 25 communities at the end of October 2017. The Department planned to assess the remaining buildings by the end of 2019. As a result, buildings in selected communities will have gone up to almost seven years without a detailed assessment.

69. We also found that the Department required annual inspections of thermosyphons (a system used to keep a foundation and surrounding permafrost cold). We found that the inspection procedure for thermosyphons was not integrated into the electronic system used by the Department to manage its maintenance activities. As a result, these inspections were not taking place. During our audit, the Department took steps to address this issue. According to the Department, at least 3 of the 13 systems under its responsibility had experienced problems.

70. For the Nunavut Housing Corporation, we found that it required that its buildings undergo detailed condition rating assessments every two years. These assessments follow a standardized template that covers structural issues, such as building foundations that could be affected by changes to permafrost. We found, on the basis of data provided by the Corporation, that fewer than half (about 43 percent) of its public housing units underwent a condition rating assessment between October 2015 and October 2017. We noted that to strengthen its maintenance practices, the Corporation had recently increased the number of staff in its Territorial Maintenance Division and was planning to introduce a new system for managing its condition rating assessments.

71. **Recommendation.** The Department of Community and Government Services should standardize its building assessment procedures and complete its building assessments according to its required schedule.

The Department of Community and Government Services' response. *Agreed. The Department of Community and Government Services will work with all internal organizations to standardize its building assessment procedures and complete building assessments of Government of Nunavut infrastructure in the year scheduled.*

72. **Recommendation.** The Nunavut Housing Corporation should ensure that it completes its condition rating assessments according to its schedule.

The Nunavut Housing Corporation's response. *Agreed. The Nunavut Housing Corporation will work with its Local Housing Organizations to ensure building condition ratings are completed according to schedule. The Corporation expects to implement a new building-condition software system in the 2018–19 fiscal year.*

73. **Snow and water management.** We found that the operations and maintenance procedures followed by the Department of Community and Government Services and the Nunavut Housing Corporation did not fully reflect practices recommended in Canadian standards for managing snow and water around buildings, which can help prevent permafrost degradation. Municipal governments play an important role in managing snow and drainage in their communities, including around government facilities. It will be important to involve them in any discussions regarding snow and water management.

74. **Recommendation.** The Department of Community and Government Services and the Nunavut Housing Corporation should develop best practices for managing snow and water to prevent permafrost degradation for their owned buildings and incorporate these practices into their operations and maintenance procedures. Where applicable, the two organizations should involve municipal governments in the discussions on snow and water management.

The Department of Community and Government Services' response. *Agreed. The Department of Community and Government Services will work with stakeholders, specifically the Nunavut Association of Municipalities, to educate and support the municipalities in the development and use of best practices for managing snow and water to prevent permafrost degradation of infrastructure objects.*

The Nunavut Housing Corporation's response. *Agreed. The Nunavut Housing Corporation will work with the Department of Community and Government Services and municipalities to improve the management of drainage and snow accumulation issues.*

Selected Government of Nunavut organizations took steps to improve the energy efficiency of some of their assets but faced barriers to reducing greenhouse gas emissions and Nunavut's dependence on fossil fuels

What we found

75. We found that the Qulliq Energy Corporation, the Department of Community and Government Services, and the Nunavut Housing Corporation acted to improve the energy efficiency of some assets, including power plants, government buildings in Iqaluit, and new public housing units. The Qulliq Energy Corporation and the Department of Community and Government Services also had some small renewable energy projects in place. There were, however, barriers to reducing greenhouse gas emissions and Nunavut's dependence on fossil fuels.

76. Our analysis supporting this finding presents what we examined and discusses the following topics:

- Qulliq Energy Corporation
- Nunavut Housing Corporation
- Department of Community and Government Services

Why this finding matters

77. This finding matters because improving the energy efficiency of government-owned assets (such as power plants and buildings) and getting power from renewable energy sources can help reduce Nunavut's demand for fossil fuels and greenhouse gas emissions.

Recommendations

78. Our recommendations in this area of examination appear at paragraphs 91, 99, 100, and 105.

Analysis to support this finding

79. **What we examined.** We examined whether the Qulliq Energy Corporation, the Department of Community and Government Services, and the Nunavut Housing Corporation took steps to improve energy efficiency and were using renewable energy to reduce energy consumption and greenhouse gas emissions. We did not audit the costs and benefits associated with the various projects discussed in this section.

80. **Qulliq Energy Corporation.** The Qulliq Energy Corporation supplies electricity to each of Nunavut's 25 communities through stand-alone diesel power plants and community distribution grids. In the 2015–16 fiscal year, the Corporation established a goal to reduce its dependence on fossil fuels by two percent by 2019. The Corporation told us that it would achieve this through improved fuel efficiency.

81. We found that the Corporation replaced or upgraded several of its power plants and was maintaining and operating them more efficiently. According to the Corporation's data, although its consumption of diesel fuel increased between the 2012–13 and 2015–16 fiscal years, the Corporation was producing more power per litre of diesel, a sign that the fuel efficiency of its power plants had improved.

82. The Corporation was also operating district heating systems. These systems capture residual heat generated through electricity production at power plants and distribute the heat to customers for heating buildings. Using residual heat helps reduce the use of heating fuels and the emissions of greenhouse gases.

83. We found that although there was infrastructure for these systems in 9 communities, the Corporation was supplying heat to customers in only 4—Iqaluit, Rankin Inlet, Arviat, and Kugluktuk. The system in Pangnirtung was temporarily not operating due to a fire at the community's power plant. The other systems were no longer operating, but according to the Corporation, documentation on why was incomplete. The Corporation's data showed that between January 2014 and December 2016, the four operating systems had on average

- reduced customer demand for heating fuels (and reduced associated greenhouse gas emissions) by an estimated 2 million litres annually, and
- generated about $1.8 million per year in revenues.

84. According to the Corporation, district heating systems can be costly to build and upgrade, and these costs were a barrier to further enhancing and expanding these systems in Nunavut. The Corporation was exploring federal funding opportunities to help overcome this barrier.

85. We also found that the Corporation had taken steps toward using renewable energy (Exhibit 4).

Exhibit 4 The Qulliq Energy Corporation was investigating the use of renewable energy

Solar power. In 2016, the Qulliq Energy Corporation installed a small demonstration project on solar energy at its Iqaluit power plant. According to the Corporation, the project improved its knowledge of how solar panels perform in the Arctic. In 2017, the Corporation assessed the costs and benefits of installing a 500-kilowatt solar energy project in Iqaluit. The project was estimated to cost almost $7.5 million and to reduce fuel consumption by an estimated 196,000 litres per year and greenhouse gas emissions by an estimated 615 tonnes per year.

Wind power. In 2016, a study produced for the Qulliq Energy Corporation identified five communities with the highest potential for harnessing wind resources (Arviat, Baker Lake, Iqaluit, Rankin Inlet, and Sanikiluaq). The study estimated that wind turbines could displace diesel use by about 18 to 56 percent in these communities and would cost about $4.2 million to $68.8 million to install.

Hydroelectric power. The Corporation investigated using hydroelectric power in Iqaluit, which, according to the Corporation, could reduce the Corporation's annual fuel consumption by up to an estimated 30 percent and provide a meaningful reduction in the territory's greenhouse gas emissions. Hydro generators are also less expensive to maintain than their diesel counterparts. In the 2013–14 fiscal year, the initiative was suspended in part due to the large capital investment required (over $350 million in 2013).

86. We found that the Corporation was planning to implement a net-metering program that would encourage small-scale renewable energy projects. Under the program, customers who generate electricity (for example, using solar panels) can send unused power to the Corporation and receive a credit. By using renewable energy, customers reduce their demand for fossil fuels, reduce greenhouse gas emissions, and save energy costs. The program was still being finalized at the time of our audit.

87. According to the Corporation, there were a number of barriers to large-scale renewable energy projects:

- high capital costs, including the cost of batteries to store power;
- the need to replace or upgrade aging power plants in 13 communities, which limited the Corporation's capacity to invest in other areas;
- technical challenges, such as the icing of wind turbine blades; and
- the need to ensure that local power plants and transmission grids remain stable when receiving intermittent energy generated by third parties using renewable energy.

88. We found that the Corporation was taking steps to overcome the capital cost of large renewable energy projects by considering federal funding opportunities and third-party financing and operation of these projects.

89. We also found that the Corporation was working to have the *Qulliq Energy Corporation Act* amended so that it could purchase power from third parties. It was also developing an independent power producers policy, which would outline to third parties how the Corporation would integrate power from them. The Corporation identified the end of 2018 as a timeline for completing these actions.

90. We found that the Corporation reported the fuel efficiency of its diesel power plants annually; however, it did not compare it with past performance, making it difficult to interpret trends. We also found that the Corporation did not set targets on using alternative energy, such as how many litres of diesel it wants to reduce by using renewable energy, or the proportion of total energy it wants to generate using alternative sources. It would be important to have such targets to assess the Corporation's performance and to frame its approach to renewable energy. In addition, although the Corporation had investigated a number of different renewable energy options, it had not identified which initiatives will be priorities.

91. **Recommendation.** The Qulliq Energy Corporation should establish priorities and targets for renewable energy (such as what share of its energy production it wants to come from renewable energy). Targets should have a baseline and timelines against which the Corporation can measure performance. Future reporting by the Corporation should include its progress on its priorities and performance against targets.

The Qulliq Energy Corporation's response. *Agreed. The Qulliq Energy Corporation will consult with the Government of Nunavut to determine the territory's renewable energy objectives. Following the consultation phase, the Corporation will review territorial objectives within the context of the Corporation's unique operating environment; set the appropriate priorities, targets, and timelines; and report accordingly. The Corporation anticipates that the deployment of renewable energy technology will be impacted by the Corporation's small rate base, along with financial, geographical, and technical challenges. These factors will need to be reconciled with the Corporation's primary objective of delivering reliable and affordable energy in an Arctic setting.*

92. **Nunavut Housing Corporation.** We examined measures the Nunavut Housing Corporation took to improve the energy efficiency of new public housing units. We found that the Corporation had installed energy-efficient lighting, appliances, and boilers into its new public housing units. It had also included improved insulation and energy-efficient windows in its new units to make them airtight and reduce heat loss. According to the results of a desktop evaluation, these

new units exceeded the energy-efficiency requirements of the National Building Code of Canada. Although the Corporation did not have any renewable energy projects, it had plans to install a small-scale solar panel project in Baker Lake to understand its potential energy performance and maintenance requirements.

93. According to an analysis done by the Corporation, selected housing units built between 2006 and 2012 used from 10 to 13 percent less fuel (savings of about $600 in fuel costs) per unit per year compared with older units built in the 1980s and 1990s. However, the Corporation's data indicated that per-unit costs for fuel and electricity increased between the 2011–12 and 2016–17 fiscal years.

94. We found that the Corporation did not have information on how the efficiency measures it introduced had performed. In 2017, the Corporation hired a financial analyst to analyze its fuel and electricity use, including consumption trends. According to the Corporation, an Energy Initiatives Coordinator position was created in 2015 to ensure that energy efficiency was maintained and improved for public housing units. However, the position was not filled.

95. We found that the Corporation did not set targets for reducing fuel and electricity use, nor did it report on trends in its fuel and electricity use. Setting a target and reporting on trends is important for assessing the impact that the Corporation's energy-efficiency measures are having.

96. We also examined the Corporation's maintenance of heat recovery ventilators (HRVs) in its public housing units. Because energy-efficient homes are designed to be airtight, with limited air circulation, HRVs are used to replace indoor air with fresh outdoor air. They help ensure good indoor air quality, control humidity, and avoid moisture build up, which can contribute to mold.

97. The Canada Mortgage and Housing Corporation commissioned a study on HRVs in northern Canada. Released in 2017, the study identified problems with installing, operating, and maintaining HRVs. These issues, along with the lack of HRVs in some housing units, were identified as potential reasons behind the presence of mold in some of the Nunavut Housing Corporation's public housing units.

98. According to the Nunavut Housing Corporation, it has HRV units in 2,181 of its public housing units across the territory and requires all new public units to have HRVs. We found that it was not carrying out maintenance of its HRVs as required by its procedures. According to the Corporation's data, 18 percent of the HRVs in its public housing units received required annual inspections and servicing during the 2016–17 fiscal year. In 15 communities, none of the HRVs received annual maintenance. We noted that the Corporation was assessing options on how to improve its inspection and maintenance of HRVs.

99. **Recommendation.** The Nunavut Housing Corporation should set targets for fuel and electricity savings. Future reporting should include how fuel and electricity use has changed over time and discuss how the Corporation performed against its targets.

The Nunavut's Housing Corporation's response. *Agreed. The Nunavut Housing Corporation plans to evaluate fuel and electrical consumption to identify areas offering potential savings based on any available funding specifically allocated for energy retrofits. Targets and future reporting will be informed by the results of this work, with the understanding that prioritization of this work will be dependent on Government of Nunavut mandates and the direction of the Corporation's Board of Directors. The Corporation will comply with codes related to building design and energy efficiency in a northern climate.*

100. **Recommendation.** The Nunavut Housing Corporation should take appropriate steps to ensure that heat recovery ventilators (HRVs) are maintained as required under its maintenance program.

The Nunavut Housing Corporation's response. *Agreed. The Nunavut Housing Corporation will ensure maintenance programs related to heat recovery ventilators (HRVs) are implemented according to schedule.*

101. **Department of Community and Government Services.** We examined the Nunavut Energy Management Program of the Department of Community and Government Services. The program uses private-sector firms to conduct energy retrofits to government buildings, using future energy savings to repay the cost of the retrofits. The program set two objectives: a 20 percent reduction in energy consumption and an associated reduction in greenhouse gas emissions.

102. The program began in the 2008–09 fiscal year with a pilot project in Iqaluit to retrofit 37 Government of Nunavut buildings. This included replacing existing interior and exterior lighting with new energy-efficient lights and fixtures; and installing heat-recovery systems, solar hot-water heating systems (Exhibit 5), and solar walls for air pre-heating.

Exhibit 5 Solar energy is used for hot water heating at the Akausisarvik Building (formerly the Taammativvik Residence) in Iqaluit

Photo: © Office of the Auditor General of Canada

103. According to the Department, the Iqaluit project cost $12.8 million and led to more than $1.8 million per year in savings in utility costs (including water, fuel, and electricity). It also reduced greenhouse gas emissions by approximately 2,090 tonnes per year. In mid-2017, the Department received approval to expand the program to the Kivalliq Region.

104. We found that the Department of Community and Government Services reported on the Iqaluit pilot project on its website. However, its reporting on the project's costs and energy savings did not reflect current internal data and did not include reporting on estimated greenhouse gas reductions.

105. **Recommendation.** The Department of Community and Government Services should ensure that its public reporting on the Nunavut Energy Management Program is up to date.

The Department of Community and Government Services' response. *Agreed. The Department of Community and Government Services will endeavour to ensure that information pertaining to the Nunavut Energy Management Program is up to date on the Department's website.*

Conclusion

106. We concluded that the Government of Nunavut had a strategy for adapting to climate change, which considered potential changes and impacts on current and future generations. The government also had an energy strategy, which included policy actions aimed at reducing greenhouse gas emissions. However, both strategies lacked plans that outlined how the strategies would be implemented and who would be responsible for what. The government had also not fully assessed the risks of climate change to Nunavut.

107. We also concluded that selected Government of Nunavut organizations had measures to safeguard government buildings from the impacts of climate change on permafrost, but these measures were not fully implemented. Selected government organizations took steps to make government assets more energy efficient. However, there were a number of barriers to implementing alternatives to fossil fuels, which would help reduce greenhouse gas emissions and the territory's reliance on fossil fuels.

About the Audit

This independent assurance report was prepared by the Office of the Auditor General of Canada on the response to climate change in Nunavut by the Department of Environment, the Department of Community and Government Services, the Nunavut Housing Corporation, and the Qulliq Energy Corporation. Our responsibility was to provide objective information, advice, and assurance to assist the Legislative Assembly in its scrutiny of the government's management of resources and programs, and to conclude on whether selected departments' implementation of climate change measures complied in all significant respects with the applicable criteria.

All work in this audit was performed to a reasonable level of assurance in accordance with the Canadian Standard for Assurance Engagements (CSAE) 3001—Direct Engagements set out by the Chartered Professional Accountants of Canada (CPA Canada) in the CPA Canada Handbook—Assurance.

The Office applies Canadian Standard on Quality Control 1 and, accordingly, maintains a comprehensive system of quality control, including documented policies and procedures regarding compliance with ethical requirements, professional standards, and applicable legal and regulatory requirements.

In conducting the audit work, we have complied with the independence and other ethical requirements of the relevant rules of professional conduct applicable to the practice of public accounting in Canada, which are founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality, and professional behaviour.

In accordance with our regular audit process, we obtained the following from entity management:

- confirmation of management's responsibility for the subject under audit;
- acknowledgement of the suitability of the criteria used in the audit;
- confirmation that all known information that has been requested, or that could affect the findings or audit conclusion, has been provided; and
- confirmation that the audit report is factually based.

Audit objective

The objective of this audit was to determine whether selected Government of Nunavut organizations took measures to reduce the territory's emissions of greenhouse gases and to adapt to climate change impacts, taking into account these impacts on current and future generations.

Scope and approach

In the 2016–17 fiscal year, many legislative audit offices across Canada decided to look at the issue of climate change and developed similar audit approaches and questions to examine climate change action within their governments. As part of this initiative, the Office of the Auditor General of Canada decided to do climate change audits of all territories.

We examined whether the Government of Nunavut had a strategy and action plan in place for adapting to climate change and reducing greenhouse gas emissions; whether it was monitoring and reporting on progress made in implementing its strategy; and whether it had assessed the risks of climate change. This part of the audit focused primarily on the Department of Environment.

We also examined specific measures that the Department of Community and Government Services, the Nunavut Housing Corporation, and the Qulliq Energy Corporation took to reduce Nunavut's greenhouse gas emissions and its dependence on fossil fuels, through energy-efficiency improvements and renewable energy initiatives.

We also examined specific adaptation efforts of the Department of Community and Government Services, and the Nunavut Housing Corporation. In particular, we examined whether permafrost changes that can occur due to climate change were considered to inform the design of infrastructure and during the assessment of buildings (for example, schools, health centres, and housing units).

The audit involved reviewing and analyzing documents, interviews, and site visits. Department officials were interviewed as well as community stakeholders and representatives of local governments. We conducted field work in Iqaluit and in a select number of communities.

We did not examine the role of other Government of Nunavut departments, such as the Department of Finance, the Department of Executive and Intergovernmental Affairs, and the Department of Economic Development and Transportation, or municipal governments.

Criteria

Criteria	Sources
To determine whether selected Government of Nunavut organizations took measures to reduce the territory's emissions of greenhouse gases and to adapt to climate change impacts, taking into account these impacts on current and future generations, we used the following criteria:	
The Government of Nunavut has a reduction target for greenhouse gas emissions.	• Vancouver Declaration on Clean Growth and Climate Change, 2016 • Ikummatiit: The Government of Nunavut Energy Strategy, 2007 • Upagiaqtavut: Climate Change Impacts and Adaptation in Nunavut, 2011 • Pan-Territorial Adaptation Strategy: Moving Forward on Climate Change Adaptation in Canada's North, 2011 • Mitigation Goal Standard: An Accounting and Reporting Standard for National and Subnational Greenhouse Gas Reduction Goals, World Resources Institute, 2014

Criteria	Sources
To determine whether selected Government of Nunavut organizations took measures to reduce the territory's emissions of greenhouse gases and to adapt to climate change impacts, taking into account these impacts on current and future generations, we used the following criteria: (continued)	
The Government of Nunavut has a strategy with clear and measurable targets and related action plans to • meet commitments to mitigate (reduce) greenhouse gas emissions, and • to adapt to climate change.	• Vancouver Declaration on Clean Growth and Climate Change, 2016 • Ikummatiit: The Government of Nunavut Energy Strategy, 2007 • Upagiaqtavut: Climate Change Impacts and Adaptation in Nunavut, 2011 • Pan-Territorial Adaptation Strategy: Moving Forward on Climate Change Adaptation in Canada's North, 2011 • *Qulliq Energy Corporation Act*
The Government of Nunavut assesses climate change risks, impacts, and vulnerabilities at the government and entity-specific levels.	• Upagiaqtavut: Climate Change Impacts and Adaptation in Nunavut, 2011 • Pan-Territorial Adaptation Strategy: Moving Forward on Climate Change Adaptation in Canada's North, 2011 • Vancouver Declaration on Clean Growth and Climate Change, 2016 • Framework for the Management of Risk, Treasury Board of Canada Secretariat, 2010
The Government of Nunavut implements selected mitigation and adaptation actions. The government is tracking implementation and regularly reports on progress.	• Ikummatiit: The Government of Nunavut Energy Strategy, 2007 • Upagiaqtavut: Climate Change Impacts and Adaptation in Nunavut, 2011 • Mitigation Goal Standard: An Accounting and Reporting Standard for National and Subnational Greenhouse Gas Reduction Goals, World Resources Institute, 2014 • ISO 14001:2015 standard on environmental management systems, International Organization for Standardization • G4 Sustainability Reporting Guidelines: Reporting Principles and Standard Disclosures, Global Reporting Initiative, 2015

Period covered by the audit

The audit covered the period between 1 January 2011 and 31 May 2017. This is the period to which the audit conclusion applies. However, to gain a more complete understanding of the subject matter of the audit, we also examined certain matters that preceded the starting date of this period and certain matters that followed the ending date of this period up until October 2017.

Date of the report

We obtained sufficient and appropriate audit evidence on which to base our conclusion on 22 January 2018, in Ottawa, Canada.

Audit team

Principal: Jim McKenzie
Director: Liliane Cotnoir

Samira Drapeau
Merkevia Isaac
Sophia Khan
Adrienne Scott

List of Recommendations

The following table lists the recommendations and responses found in this report. The paragraph number preceding the recommendation indicates the location of the recommendation in the report, and the numbers in parentheses indicate the location of the related discussion.

Recommendation	Response
Planning and preparing	
36. The Department of Environment, in collaboration with other key departments, should develop an implementation plan for the Government of Nunavut's climate change strategies that • identifies priorities along with concrete actions, timelines, and costs; • includes reduction targets for greenhouse gas emissions; • clearly identifies roles and responsibilities, including who is responsible for overseeing the implementation of the plan and accountabilities for implementing actions; and • requires monitoring and reporting on the plan's progress. The plan should consider actions taken to date and be informed by an assessment of climate change risks. **(19–35)**	**The Department of Environment's response.** Agreed. The Department of Environment, through the Climate Change Secretariat, will collaborate with other key departments to identify priorities, concrete actions, timelines, costs, and implementation plans for climate change strategies. These strategies aim to take action on Nunavut's greenhouse gas emissions, reliance on diesel fuel, and role in adapting and combatting climate change. The Climate Change Secretariat was formed in November 2016 and has since begun work on a variety of foundational projects that will well position the Department of Environment to facilitate responding to such a recommendation. Preliminary work on community energy planning, greenhouse gas emissions, and alternative energy inventories will support the Government of Nunavut's ability to identify realistic and reasonable greenhouse gas emission targets.
49. The Department of Environment's Climate Change Secretariat, in collaboration with other Government of Nunavut organizations, should analyze and rank the risks of climate change to Nunavut on the basis of their potential impacts and how likely they are to occur. Results of this analysis should be used to inform future climate change priorities and actions. **(37–48)**	**The Department of Environment's response.** Agreed. The Department of Environment intends to work with other Government of Nunavut organizations and external bodies to identify and rank climate change risks and hazards to Nunavut. The Department of Environment will host a pan-northern meeting in March 2018 on permafrost hazard mapping. This will bring northern communities and government decision makers together to determine risks, opportunities, and recommendations to better manage and respond to permafrost thaw and other climate change risks. Best practices and lessons learned from this session will help inform future work conducted to address other identified risks. Additional work is scheduled to begin the development of climate change risk mitigation criteria for decision makers.

Recommendation	Response
Taking action	
64. The Department of Community and Government Services and the Nunavut Housing Corporation should ensure that climate change projections are incorporated into geotechnical site investigations where required. **(58–63)**	**The Department of Community and Government Services' response.** Agreed. The Department of Community and Government Services will initiate measures to ensure that climate change projections are incorporated into the geotechnical site investigations where required going forward. **The Nunavut Housing Corporation's response.** Agreed. The Nunavut Housing Corporation will incorporate climate change predictions into future geotechnical studies, where necessary.
71. The Department of Community and Government Services should standardize its building assessment procedures and complete its building assessments according to its required schedule. **(58–62, 65–69)**	**The Department of Community and Government Services' response.** Agreed. The Department of Community and Government Services will work with all internal organizations to standardize its building assessment procedures and complete building assessments of Government of Nunavut infrastructure in the year scheduled.
72. The Nunavut Housing Corporation should ensure that it completes its condition rating assessments according to its schedule. **(58–62, 65, 70)**	**The Nunavut Housing Corporation's response.** Agreed. The Nunavut Housing Corporation will work with its Local Housing Organizations to ensure building condition ratings are completed according to schedule. The Corporation expects to implement a new building-condition software system in the 2018–19 fiscal year.
74. The Department of Community and Government Services and the Nunavut Housing Corporation should develop best practices for managing snow and water to prevent permafrost degradation for their owned buildings and incorporate these practices into their operations and maintenance procedures. Where applicable, the two organizations should involve municipal governments in the discussions on snow and water management. **(58–62, 73)**	**The Department of Community and Government Services' response.** Agreed. The Department of Community and Government Services will work with stakeholders, specifically the Nunavut Association of Municipalities, to educate and support the municipalities in the development and use of best practices for managing snow and water to prevent permafrost degradation of infrastructure objects. **The Nunavut Housing Corporation's response.** Agreed. The Nunavut Housing Corporation will work with the Department of Community and Government Services and municipalities to improve the management of drainage and snow accumulation issues.
91. The Qulliq Energy Corporation should establish priorities and targets for renewable energy (such as what share of its energy production it wants to come from renewable energy). Targets should have a baseline and timelines against which the Corporation can measure performance. Future reporting by the Corporation should include its progress on its priorities and performance against targets. **(75–90)**	**The Qulliq Energy Corporation's response.** Agreed. The Qulliq Energy Corporation will consult with the Government of Nunavut to determine the territory's renewable energy objectives. Following the consultation phase, the Corporation will review territorial objectives within the context of the Corporation's unique operating environment; set the appropriate priorities, targets, and timelines; and report accordingly. The Corporation anticipates that the deployment of renewable energy technology will be impacted by the Corporation's small rate base, along with financial, geographical, and technical challenges. These factors will need to be reconciled with the Corporation's primary objective of delivering reliable and affordable energy in an Arctic setting.

Recommendation	Response
99. The Nunavut Housing Corporation should set targets for fuel and electricity savings. Future reporting should include how fuel and electricity use has changed over time and discuss how the Corporation performed against its targets. **(75–79, 92–98)**	**The Nunavut's Housing Corporation's response.** Agreed. The Nunavut Housing Corporation plans to evaluate fuel and electrical consumption to identify areas offering potential savings based on any available funding specifically allocated for energy retrofits. Targets and future reporting will be informed by the results of this work, with the understanding that prioritization of this work will be dependent on Government of Nunavut mandates and the direction of the Corporation's Board of Directors. The Corporation will comply with codes related to building design and energy efficiency in a northern climate.
100. The Nunavut Housing Corporation should take appropriate steps to ensure that heat recovery ventilators (HRVs) are maintained as required under its maintenance program. **(75–79, 92–98)**	**The Nunavut Housing Corporation's response.** Agreed. The Nunavut Housing Corporation will ensure maintenance programs related to heat recovery ventilators (HRVs) are implemented according to schedule.
105. The Department of Community and Government Services should ensure that its public reporting on the Nunavut Energy Management Program is up to date. **(75–79, 101–104)**	**The Department of Community and Government Services' response.** Agreed. The Department of Community and Government Services will endeavour to ensure that information pertaining to the Nunavut Energy Management Program is up to date on the Department's website.